



Pipeline and Hazardous Materials Safety Administration

Office of Pipeline Safety

PHMSA Public Meeting

PHMSA Carbon Dioxide Pipeline Safety Regulations

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US DOT - PHMSA – Office of Pipeline Safety, Engineering and Research Division
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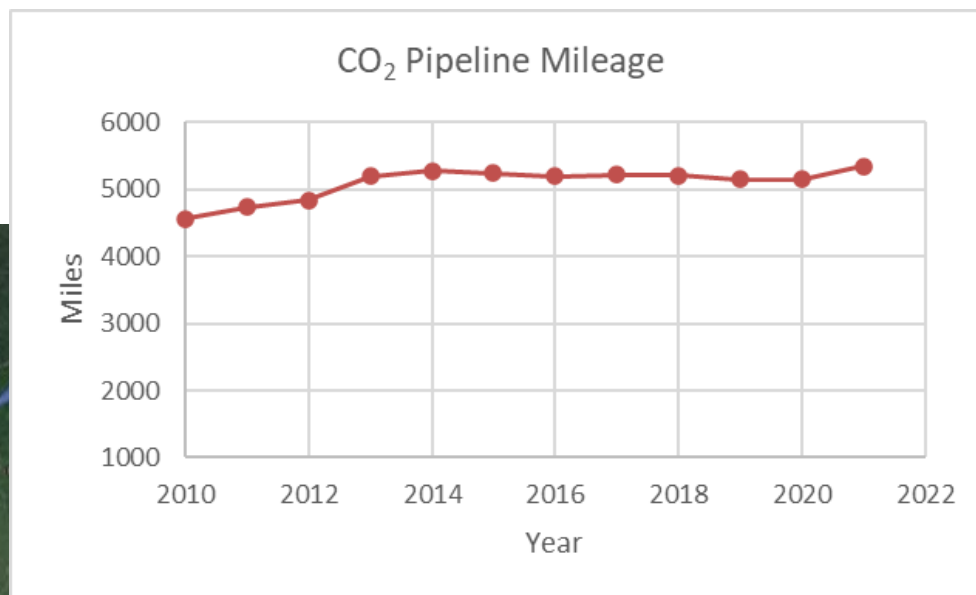
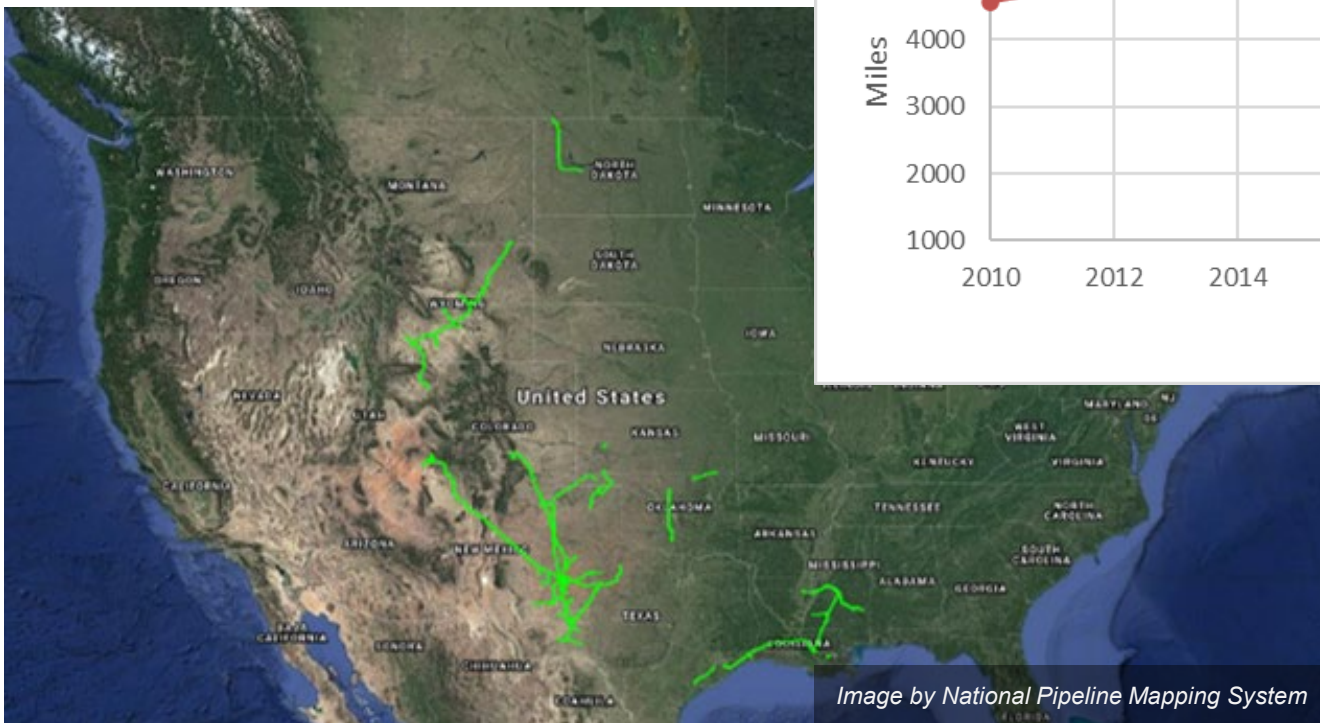
U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration

PHMSA: Your Safety is Our Mission



CO₂ Pipeline Network

5,338 Miles



All Pipelines:
PHMSA Regulates
3.3 M Miles Total

Image by National Pipeline Mapping System



Part 195 Regulations Unique to CO₂

§ 195.2 Definitions.(...)

Carbon dioxide means a fluid consisting of more than 90 percent carbon dioxide molecules compressed to a supercritical state.

§ 195.4 Compatibility necessary for transportation of hazardous liquids or carbon dioxide.

No person may transport any hazardous liquid or carbon dioxide unless the hazardous liquid or carbon dioxide is chemically compatible with both the pipeline, including all components, and any other commodity that it may come into contact with while in the pipeline.

§ 195.8 Transportation of hazardous liquid or carbon dioxide in pipelines constructed with other than steel pipe.

No person may transport any hazardous liquid or carbon dioxide through a pipe that is constructed after October 1, 1970, for hazardous liquids or after July 12, 1991, for carbon dioxide of material other than steel unless(...)



Part 195 Regulations Unique to CO₂

§ 195.102 Design temperature.(...)

(b) Components of **carbon dioxide pipelines** that are subject to low temperatures during normal operation because of rapid pressure reduction or during the initial fill of the line must be made of materials that are suitable for those low temperatures.

§ 195.111 Fracture propagation.

A **carbon dioxide pipeline system** must be designed to mitigate the effects of fracture propagation.

§ 195.116 Valves.(...)

(c) Each part of the valve that will be in contact with the carbon dioxide or hazardous liquid stream must be made of materials that are compatible with carbon dioxide or each hazardous liquid that it is anticipated will flow through the pipeline system.



CO₂ Pipeline Accident Data

Calendar Year	Number	Fatalities	Injuries*	Total Cost as Reported	Net Barrels Lost
2001	1	0	0	\$11,052	18
2002	4	0	0	\$12,383	317
2003	7	0	0	\$62,871	11
2004	3	0	0	\$74,101	8,182
2005	2	0	0	\$3,888	2,401
2006	7	0	0	\$763,912	25,086
2007	4	0	1	\$115,425	24,540
2008	7	0	0	\$11,444	103
2009	4	0	0	\$153,134	1,077
2010	6	0	0	\$212,521	329
2011	4	0	0	\$168,770	2,542
2012	2	0	0	\$5,823	19
2013	5	0	0	\$270,387	52
2014	5	0	0	\$32,948	2,190
2015	7	0	0	\$67,224	1,281
2016	9	0	0	\$71,029	1,709
2017	9	0	0	\$132,993	218
2018	5	0	0	\$299,047	406
2019	4	0	0	\$375,395	480
2020	6	0	0	\$4,035,553	50,903
2021	4	0	0	\$66,184	787
Total	105	0	1	\$6,946,084	122,652

**PHMSA
Pipeline Accidents:**
(2001-2021)

Incident Type:
All Reported

System Type:
Hazardous Liquid

State:
(All Column Values)

Offshore Flag:
(All Column Values)

Commodity:
CO₂



Pipeline Transportation: Hydrogen and Emerging Fuels R&D Public Meeting and Forum

Event Purpose: Assist PHMSA in developing its R&D agenda for the next two years and help address one of DOT's strategic goals to develop climate solutions. The first day of the event was a public meeting and general session focusing on two objectives: (1) The current state of PHMSA's pipeline safety R&D, and (2) The environmental and infrastructure impacts of a shift to clean emerging fuels. The second day consisted of six smaller interactive working groups to develop robust R&D topics for funding consideration by PHMSA. The final day included a report out from each working group.

Event Summary:

- Nov 30th - Dec 2nd, 2021
- Approximately 530 virtual attendees
- 25 research gap/topics identified as a priority for future research
- All presentations available from this page:

<https://primis.phmsa.dot.gov/meetings/MtgHome.mtg?mtg=153>



Developing Design and Welding Requirements Including Material Testing and Qualification of New and Existing Pipelines for Transporting CO₂

Researcher: BMT Commercial USA

Project Cost: \$1,500,000 (\$1,200,000 PHMSA + \$300,000 cost sharing)

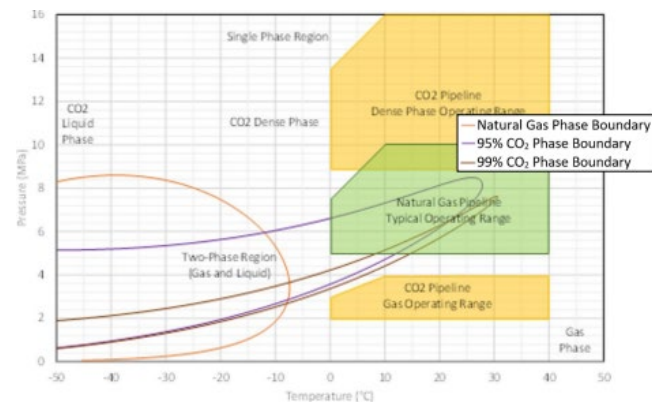
Public Page: <https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=996>

Project Objective:

- Identify unique aspects of CO₂ pipeline design, integrity, and operational considerations currently not well supported by existing knowledge.
- Define processes and procedures to fill these safety gaps.
- Identify performance-based safety targets for CO₂ pipelines.

Project End Date: 9/29/2024

Potential Impact on Safety: Will advance the safe transportation of impure CO₂ at both low pressure (gas phase) and high pressure (supercritical and dense phase), by defining the state of knowledge and how it can be applied in CO₂ pipeline design, operation, and maintenance.



Pictures courtesy BMT



Determination of Potential Impact Radius (PIR) for CO₂ Pipelines Using Machine Learning Approach

Researcher: Texas A&M Engineering Experiment Station

Project Cost: \$359,560 (\$279,754 PHMSA + \$79,806 cost sharing)

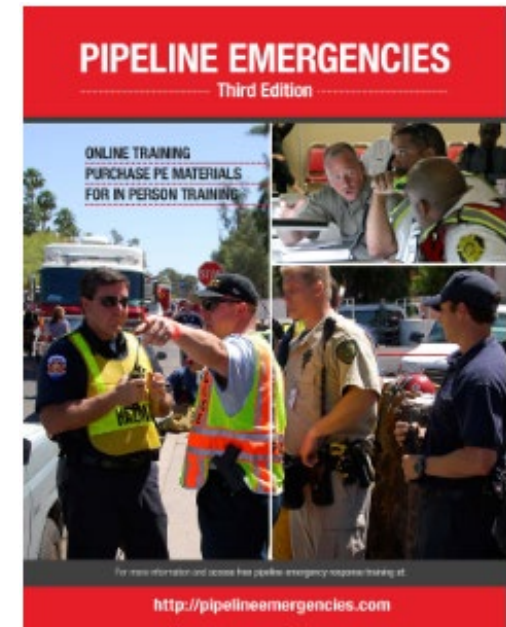
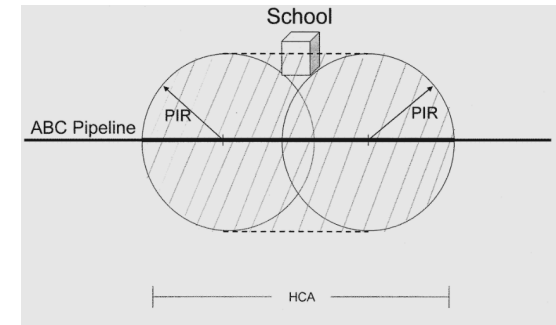
Public Page: <https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=987>

Project Objective:

- Establish a computational fluid dynamics model to simulate the release and dispersion of supercritical CO₂ from full pipeline ruptures.
- Use the simulation results to construct a database comprising CO₂ dispersion data under different scenarios.
- Use the resulting scenario data in a machine learning analysis for predicting dispersion ranges and health consequences.
- Develop a rapid, universally applicable tool to assess the consequences of accidental CO₂ dispersion from high-pressure pipelines.

Project End Date: 9/29/2025

Potential Impact on Safety: A tool to measure the impact radius will aid in the development of effective response planning.



Carbon Dioxide Pipelines Rulemaking

- **Under Development (RIN: 2137-AF60)**
- In response to:
 - PHMSA's investigation into the 2020 CO₂ pipeline failure in Satartia, MS
 - carbon capture initiatives, and
 - the growth of CO₂ pipelines – both liquid and gaseous
- **Next action:** Issuance of Notice of Proposed Rule Making
 - <https://www.phmsa.dot.gov/regulations/federal-register-documents>



R&D Links

[About Research and Development](#)

[Congressional Mandates](#)

[Meeting and Events](#)

[Program Performance](#)

[Technology Success Stories](#)

[University Partnerships](#)

[Submit Research Ideas](#)

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About Pipeline Research & Development

The mission of PHMSA's Pipeline Safety Research & Development Program is to sponsor projects focused on providing technical solutions that will improve pipeline safety, reduce the environmental impact of failures, and enhance the reliability of the Nation's pipeline transportation system.

The research program has the following objectives:

- Employ a coordinated and collaborative approach to address mutual pipeline challenges with a wide set of pipeline stakeholders
- Help remove technical and sometimes regulatory barriers on a given challenge
- Tell the research story by measuring our research results, outputs, and impacts
- Promote transparency by posting online R&D program/project actions and products.

R&D Program Website: <https://www.phmsa.dot.gov/research-and-development/pipeline/about-pipeline-research-development>

R&D program awards and sortable features: <https://primis.phmsa.dot.gov/matrix/>

Submit a research gap suggestion: <https://primis.phmsa.dot.gov/rd/gapsuggestions.htm>

Join the R&D Program Alerts Distribution List: <https://service.govdelivery.com/accounts/USDOTPHMSA/subscriber/new>



Thank You

Questions?

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